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# Characterizing and Comprehending Land Use Change in the Loess Hills Region

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# Characterizing and Comprehending Land Use Change in the Loess Hills Region

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**REGIONAL LAND** use change has important implications for ecosystems and the local human population. Metropolitan areas (MAs) are placing increasing emphasis on amenities and the environment when seeking to attract high income workers and their employers. Our interest is in characterizing land use change in Iowa's Loess Hills Ecoregion (ILHE) that skirts both Sioux City and Council Bluffs MAs. ILHE is a distinctive landform of silty soils up to 200 feet high that were wind deposited just east of the Missouri River floodplain. Covering about 0.7 million acres, the Loess hills stretch north about 200 miles (usually no wider than 15 miles) from Holt County, Missouri, to Plymouth County, Iowa and are largely under private ownership. Although the soils are rich, cultivation has been difficult so that the region contains more than 50 percent of Iowa's remnant prairie. However, technologies that allow cropping on steeply sloped and highly erodible terrains, increasing agricultural prices, and pressure for urban development have led to concerns about habitat loss conversion and fragmentation (Farnsworth et al. 2010).

Figure 1 illustrates the landform, within the red boundary, and also land uses as of 2013. In this article we will consider land use change in the ILHE and seek to place shifting land use patterns in the region in perspective with changes across the state as a whole. Data used are primarily from Cropland Data Layers (CDL) 2001–2013 as obtained from the United States Department of Agriculture (USDA).

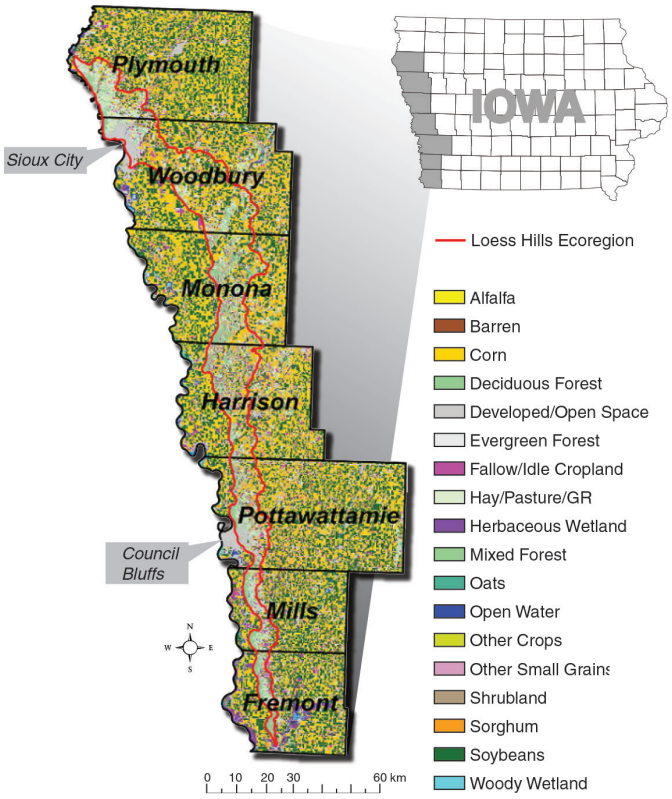


**Figure 1: Iowa's Loess Hills Ecoregion, as defined by Iowa Dept. of Natural Resources (DNR).**

## Land Use Change in the Loess Hills Ecoregion

There has been little net change in cumulative agricultural acres (predominantly corn and soybeans) between 2001 and 2013. However, within-cropland dynamics are revealing. Corn is the only crop to have gained acreage from 2001 to 2013. Among non-agricultural uses, the Grass/Pasture/Hay (henceforth, grass) acres have declined, seemingly overgrown by deciduous forests.

Much of the corn acreage that moved out of cropping between 2001 and 2005 went into grass and fallow cropland, a pattern that was reversed in the subsequent five years, such that corn was 32,000 acres higher in 2010 than in 2001. High corn acres were sustained in the 2010–2013 period through declining soybean acres. While shifts occurred into grass and fallow cropland categories, grass acres have fallen due to outward transitions into the deciduous forests category where invasive eastern red cedar is a problem. Because CDL classification protocols for developed acres have substantially evolved through these years, CDL data do not directly allow for an assessment of change to this category. In a separate query that appropriately adjusted for the redefinitions, we found a 2.6 percent increase in ILHE development acres (from 25,494 acres to 26,163 acres) over the 2001–2013 period. We had expected a larger increase.

Since the CDL data are less reliable for gauging changes in the developed land category, we also created land transition tables (not shown) using point-level National Resource Inventory data, a distinct data set, for the seven counties that enclose the ILHE. These data hold that corn/soy (58 percent) have contributed more acres to urbanization than have pasture/hay (27 percent) and Conservation Reserve Program (CRP) (15 percent) categories from 2001 to 2010. In 2001, 80 percent of land in the seven counties were under either corn or soybeans, 13 percent were in pasture/hay and 3 percent were in CRP, thus acres entering development in these counties were

disproportionately drawn from non-crop uses.

### Land Use Change in Iowa

At the national level, corn and soybean acres planted and harvested have increased during the first decade of the twenty-first century (Wallender et al. 2011). The large majority of Iowa's most productive land has long been under cultivation in a corn-soybean rotation. National Agricultural Statistics Service land use data depict little change in total corn and soybean acreage between 2001 and 2013 in Iowa and in the seven Loess Hills' counties. Data also highlights a shift toward corn within corn-soybean rotations, especially in the seven Loess Hills counties.

A further change has been in acreage enrolled in CRP. Enrollment peaked at above 2 million acres in the mid-1990s before settling in the 1.5–2 million interval up until recent cutbacks in the national enrollment cap and higher commodity prices during 2007–2013. The seven Loess Hills' counties CRP acreage trends are quite similar to those in the entire state; however, CRP acreage rose faster in the seven Loess Hills' counties until the mid-1990s, and the seven county decline in post-2007 CRP acres has also outpaced Iowa. It is noteworthy that fallow cropland has apparently increased in the ILHE despite a decline in CRP acres for the seven counties.

### Discussion

Satellite-data based assessments of land use changes in developed areas, grassland, and fallow cropland categories should be treated with caution (Kline et al. 2013), and so our emphasis has been on changes in row cropping. About half of the landform's area is under tilled crops while significant amounts of previously cropped land are also under expiring CRP contracts. The advent of reduced till and glyphosate seed technologies has likely meant that the area's difficult terrain is becoming less problematic for cultivation. Crop production has increased in profitability since 2000—according to Iowa State University's annual rental rate survey, average cropland rental rates in the seven county region have increased from $119/acre in 2002 to $273/acre in 2014. We are therefore somewhat surprised to conclude that more land has not been converted to row-crop agriculture in the area.

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